

WHAT IS CLAIMED IS:

1. A method of measuring a complex dielectric constant of a dielectric, comprising the steps of:

filling a mode generator with a dielectric;

5 inputting an electromagnetic wave to the mode generator;

measuring an electromagnetic wave output from the mode generator; and

calculating a complex dielectric constant based on the electromagnetic wave thus measured.

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2. The method of measuring a complex dielectric constant of a dielectric according to claim 1, wherein the dielectric is a powder-like dielectric,

15 the mode generator is filled with a gas together with the dielectric,

an S parameter of the electromagnetic wave is measured at the measuring step, and

the calculating step includes a step of calculating a complex dielectric constant of a mixture obtained by mixing the dielectric and the gas in the mode generator based on the S parameter, and

20 a step of calculating the complex dielectric constant of the dielectric from the complex dielectric constant of the mixture which is calculated and a volume ratio of the dielectric in the mixture.

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3. The method of measuring a complex dielectric constant of a dielectric according to claim 2, wherein the calculation of the complex dielectric constant of the mixture is a calculation of a dielectric constant of the mixture, and the calculation of the complex dielectric constant of the dielectric is a calculation of a dielectric constant of the dielectric.

4. The method of measuring a complex dielectric constant of a dielectric according to claim 3, wherein the dielectric constant of the dielectric is calculated by using one of a logarithmic alligation, an equation of "Lichteneker Rother" and an equation of Wiener.

5. The method of measuring a complex dielectric constant of a dielectric according to any of claims 2 to 4, wherein the calculation of the complex dielectric constant of the mixture is a calculation of a dielectric loss tangent of the mixture, and the calculation of the complex dielectric constant of the dielectric is a calculation of a dielectric loss tangent of the dielectric.

6. The method of measuring a complex dielectric constant of a dielectric according to claim 5, wherein the

calculation of the dielectric loss tangent of the dielectric is carried out by using an equation of the alligation.

7. The method of measuring a complex dielectric constant of a dielectric according to claim 1, wherein the dielectric is a dielectric molding having the same section as a section of a closed space of the mode generator,

the mode generator is filled with a gas together with the dielectric,

10 a resonance frequency, an insertion loss and a half-power width in a resonance mode of the electromagnetic wave are measured at the measuring step, and

a complex dielectric constant of the dielectric molding is calculated, at the calculating step, from the resonance frequency, the insertion loss and the half-power width which are thus measured.

8. The method of measuring a complex dielectric constant of a dielectric according to claim 7, wherein the calculation of the complex dielectric constant of the dielectric molding is a calculation of a dielectric constant of the dielectric molding.

9. The method of measuring a complex dielectric constant of a dielectric according to claim 7, wherein the

calculation of the complex dielectric constant of the dielectric molding is a calculation of a dielectric loss tangent of the dielectric molding.

5 10. The method of measuring a complex dielectric constant of a dielectric according to claim 7, wherein the dielectric molding is columnar.

10 11. The method of measuring a complex dielectric constant of a dielectric according to claim 2 or 7, wherein the mode generator is a cylindrical resonator.

15 12. The method of measuring a complex dielectric constant of a dielectric according to claim 2 or 7, wherein the mode generator is a cavity resonator.

20 13. The method of measuring a complex dielectric constant of a dielectric according to claim 2 or 7, wherein the resonance mode of the electromagnetic wave is a TE_{011} mode.

 14. The method of measuring a complex dielectric constant of a dielectric according to claims 1, 2, or 7, further comprising a step of drying the dielectric in the mode generator.

25 15. The method of measuring a complex dielectric

constant of a dielectric according to claim 14, further comprising a step of evacuating the mode generator, thereby drying the dielectric.

5 16. The method of measuring a complex dielectric constant of a dielectric according to claim 1, wherein the mode generator is a waveguide,

the waveguide is filled with a gas or a liquid together with the dielectric,

10 a dielectric constant of a mixture obtained by mixing a powder and the gas or liquid is calculated based on the measured electromagnetic wave at the calculating step, and

a dielectric constant of the powder is calculated from the dielectric constant of the mixture and a volume ratio of
15 the powder in the mixture at the calculating step.

17. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein a dielectric constant of the dielectric is calculated by using
20 one of a logarithmic alligation, an equation of "Lichteneker Rother" and an equation of Wiener.

18. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein the
25 waveguide is a coaxial-type waveguide.

19. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein the waveguide is a rectangular waveguide.

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20. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein the waveguide is a circular waveguide.

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21. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein the waveguide includes a seal portion for holding the gas or the liquid.

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22. The method of measuring a complex dielectric constant of a dielectric according to claim 16, wherein a volume ratio of the powder in the mixture is set to be 0.32 to 0.42 and a frequency of the electromagnetic wave is 0.1 GHz or more.

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23. The method of measuring a complex dielectric constant of a dielectric according to claim 17, further comprising the steps of:

measuring respective dielectric constants of a plurality of mixtures in which types of powders are different from each other and volume ratios are equal to each other, and

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comparing the dielectric constants of the mixtures,
thereby comparing and measuring dielectric constants of a
plurality of dielectrics.

5 24. An apparatus for measuring a complex dielectric
constant of a dielectric, comprising:

 a mode generator having a dielectric provided therein;
 an electromagnetic wave generating analyzer for inputting
an electromagnetic wave to the mode generator provided with the
10 dielectric and measuring the electromagnetic wave output from
the mode generator in response to the input of the electromagnetic
wave; and

 a calculating device for calculating the complex
dielectric constant of the dielectric based on the
15 electromagnetic wave thus measured.

 25. The apparatus for measuring a complex dielectric
constant of a dielectric according to claim 24, wherein the mode
generator is a resonator for filling the dielectric and a gas
20 therein,

 the electromagnetic wave generating analyzer measures a
resonance frequency, an insertion loss and a half-power width
in a resonance mode of the electromagnetic wave, and

 the calculating device calculates the complex dielectric
25 constant of the dielectric based on the resonance frequency,

the insertion loss and the half-power width.

26. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 25, wherein the resonator includes:

a first piston provided with a through hole;

a second piston provided opposite to the first piston;

a cylinder for covering the first piston and the second piston, thereby forming a closed space; and

a coaxial cable for inputting and outputting the electromagnetic wave inserted in the through hole.

27. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 26, wherein an annular groove is formed on a tip portion of the first piston and a tip portion of the second piston.

28. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 26, wherein an annular conductor plate or dielectric plate is attached to a tip portion of the first piston and a tip portion of the second piston.

29. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 25, wherein when the dielectric is a powder, the calculating device calculates

a complex dielectric constant of a mixture obtained by mixing the dielectric and the gas in the resonator from the resonance frequency, the insertion loss and the half-power width which are measured, and calculates the complex dielectric constant of the dielectric from the complex dielectric constant of the mixture which is thus calculated and a volume ratio of the dielectric in the mixture.

30. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 29, wherein the calculation of the complex dielectric constant of the mixture is a calculation of a dielectric constant of the mixture, and the calculation of the complex dielectric constant of the dielectric is a calculation of a dielectric constant of the dielectric.

31. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 30, wherein the dielectric constant of the dielectric is calculated by using one of a logarithmic alligation, an equation of "Lichteneker Rother" and an equation of Wiener.

32. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 29, wherein the calculation of the complex dielectric constant of the mixture

is a calculation of a dielectric loss tangent of the mixture,
and the calculation of the complex dielectric constant of the
dielectric is a calculation of a dielectric loss tangent of the
dielectric.

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33. The apparatus for measuring a complex dielectric
constant of a dielectric according to claim 32, wherein the
dielectric loss tangent of the dielectric is calculated by using
an equation of the alligation.

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34. The apparatus for measuring a complex dielectric
constant of a dielectric according to claim 25, wherein when
the columnar dielectric is a molding, the calculating device
calculates a complex dielectric constant of the dielectric
15 molding from the resonance frequency, the insertion loss and
the half-power width which are measured.

35. The apparatus for measuring a complex dielectric
constant of a dielectric according to claim 34, wherein the
20 calculation of the complex dielectric constant of the dielectric
molding is a calculation of a dielectric constant of the
dielectric molding.

36. The apparatus for measuring a complex dielectric
25 constant of a dielectric according to claim 34, wherein the

calculation of the complex dielectric constant of the dielectric molding is a calculation of a dielectric loss tangent of the dielectric molding.

5 37. The apparatus for measuring a complex dielectric constant of a dielectric according to claim 25, wherein the resonance mode of the electromagnetic wave is a TE_{011} mode.

 38. The apparatus for measuring a complex dielectric
10 constant of a dielectric according to claim 25, further comprising a vacuum device for evacuating a closed space in the resonator to dry the dielectric in the resonator.

 39. The apparatus for measuring a complex dielectric
15 constant of a dielectric according to claim 34, wherein the resonator is filled with a columnar dielectric molding having the same section as a section of the closed space and a gas.

 40. The apparatus for measuring a complex dielectric
20 constant of a dielectric according to claim 25, wherein the dielectric and the gas are filled in a closed space having an almost circular section which is formed in the resonator.

 41. The apparatus for measuring a complex dielectric
25 constant of a dielectric according to claim 24, wherein the mode

generator is a waveguide filled with a mixture obtained by mixing a powder of which complex dielectric constant is to be measured and a gas or a liquid.